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NINETEENTH ANNUAL REPORT

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OCT 10 1952
U. S. Department of Agriculture

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR

THE YEAR 1902.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.

SHEEP RANCHING IN THE WESTERN STATES.

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The extent and importance of the sheep industry in the United States have varied from time to time, in accordance with the price of wool, mutton, and other conditions necessary to the successful and profitable management of sheep. According to the returns of the last census there are at present in the United States about 40,000,000 sheep, exclusive of lambs under one year of age. Montana leads with the largest number of sheep in any one State, and is followed by New Mexico, Wyoming, Ohio, Utah, etc. The number of sheep in nine of the range States of the West which possess the largest numbers of sheep is about 22,000,000, or somewhat more than half of the total in the country.

The management of sheep under range conditions is totally different from that adopted in the Eastern States. In the first place, the natural conditions and environment in the Western States require a different system of management, and the extensive scale upon which the sheep industry is conducted, together with the high price of labor and the comparative inaccessibility of some of the larger sheep ranges, have rendered necessary a system of management which is tolerably uniform throughout the Western range States from Mexico to Canada. While the general system of management of the sheep industry throughout the Western States is quite uniform, certain differences prevail in different States on account of climatic and other conditions, and these will be briefly noted in so far as they are of importance to this discussion.

LAMBING.

In order to give a description of the course of operations connected with sheep raising throughout the year, it is necessary to choose some point in the cycle as a beginning. For this purpose the lambing season may be selected. The proper lambing season is the earliest time of year at which suitable climatic and feeding conditions may be expected. It is not desirable to have the lambs come before the grass starts in the spring, for the reason that without green grass the ewes might not give sufficient milk for the rapid and vigorous development of the lambs. The possibility of cold rains or late snowstorms is a serious consideration in determining this matter. The prevalence of

cold windy weather during the first month after the birth of the lambs always causes a more or less serious loss among the lambs. The actual time of year at which the lambs come naturally varies according to the latitude, being much earlier in Texas than in Montana. In the latter State the usual lambing season is the month of May. Some sheep raisers in Montana prefer a slightly earlier lambing season, beginning about the 15th of April. This must depend upon the average climatic conditions of different parts of the State, and as a rule the earlier date is unsafe.

At lambing time a large number of extra men must be hired, since the bands of ewes must be divided into small flocks as soon as the lambs have been dropped. It has been found desirable to put the older, more experienced herders in charge of lambing pens, as many complications may arise which demand some initiative and experience on the part of the herder. The actual details of lambing methods followed in different parts of the country vary greatly, but the methods practiced by certain of the more successful sheep raisers of Montana may be selected as models. As soon as the lambs begin to appear a night herder is placed in charge of the band, in order to prevent lambs which may be born during the night from being trampled to death by other ewes in the corral. The lambs are immediately removed from the corral and placed in individual lambing pens of barely sufficient size to hold the ewe and her lamb. They are kept in these pens for a number of hours until it appears that the lamb is "owned," or "mothered."

During the daytime a lambing wagon constantly follows each lambing band, and the young lambs and their mothers are placed in small apartments on either side of the lambing wagon, where they are kept until the wagon is full, when they are hauled to the lambing shed and placed in individual lambing pens. Ewes with young lambs are maintained for the first few days in small bands of 25 to 100, usually called lambing bands. Each of these bands is under the care of a herder. The reason for keeping the ewes in such small bands is to make sure that the lambs are owned by their mothers. This is an exceedingly important part of sheep raising, and is a matter that requires the careful attention of conscientious herders, for it is well known that if a ewe accidentally becomes separated from her lamb, after 24 hours or more it is very apt to forget the scent of the lamb, and for this and other reasons refuse to own the lamb in the future. All such lambs become "bums," in the usual language of sheep herders, and must be taken to the ranch house and brought up on bottles or allowed to die. The loss of the lambs is not the only unfortunate feature of allowing the lamb and mother to become separated, for a serious condition of the udder may develop in the ewe on account of the unusual amount of milk, and the ewe may thus become permanently incapable of secreting milk. In order to pre-

SHEARING SHEEP WITH MACHINE.

Photograph by Dr. D. Griffiths.

SACKS OF WOOL.

Photograph by Dr. D. Griffiths.

vent the separation or estrangement of ewes and lambs, the herder has to make sure that the lamb secures milk at reasonably frequent intervals each day for the first week or two. If any tendency is noticed in the ewe to disown the lamb, the ewe is caught and placed again in an individual lambing pen with her lamb.

At the end of the first week or ten days the small lambing bands are gradually brought together until a band of the usual size—about 2,500 to 3,000—is formed. The lambs are now ready for docking, castrating, and marking. These operations are performed at the same time and with great rapidity. The ewe bands with their lambs are driven into a corral, usually in a shed, where they may be easily secured. A number of men (four to eight) are required for manipulating the ewes and securing the lambs for the man who does the docking and castrating. At the hands of expert sheepmen these operations require so little time that 1,000 lambs may be docked, castrated, marked on the shoulder with paint and on the ear to designate sex, within a period of about two and a half to three hours.

The lamb bands are, from this time on, driven to greater distances from the home ranch, but are usually kept within a reasonable driving distance until after shearing time. The distances over which lamb bands travel during the early spring and until the lambs are one month old is considerably less than that traveled by dry bands or lamb bands in the fall.

The percentage of lambs which are raised varies greatly in different years and with different sheepmen. Under extreme conditions it may vary from 50 to nearly 100 per cent. As a rule, however, the extreme losses are due to unfortunate conditions of grazing, while the statement that 100 per cent of lambs have been successfully raised may usually be considered as an exaggeration. As a result of extensive statistics compiled in the United States and England, it appears that about 4 per cent of ewes are barren, for various reasons. The percentage of barrenness is not uniform and may be much higher than the average figures as stated. As a rule, also, from 3 to 5 per cent of the ewes abort, and from 5 to 10 per cent of the lambs die before they are 3 weeks old. Under ordinary circumstances, therefore, 80 per cent of lambs may be considered an average amount of success. This percentage allows for losses from barrenness, abortion, and death of the lambs, and also for the partial compensation of those losses by the birth of twins. Under Western conditions, however, the production of twins is considered a distinct disadvantage and is usually not desired. The reason for this is that where ewes are kept in bands of 2,000 or 3,000 they may manifest no desire to find their two lambs at sufficiently frequent intervals; the presence of one lamb appears to be perfectly satisfactory to the ewe, and the result of this condition is that one or the other of the twins almost invariably

becomes neglected and develops into a "bum." Moreover, in unfavorable years the average ewe appears to be unable to produce sufficient milk for the vigorous development of two lambs, with the result that both of the twins may be stunted.

SHEARING.

The time of year for shearing, like that for lambing, varies according to the climatic and other conditions. It is much earlier in the Southern States, where the sheep are sheared twice a year, and is latest in Montana, where shearing is done during June and until the 20th or sometimes the 25th of July. Shearing in the Western States is a business which is carried on by professional shearers, who travel from one part of the country to another as the season advances. A considerable proportion of these men work during our winter season in the southern hemisphere, especially in Australia and Argentina. In the early spring they begin shearing in Texas and proceed north until the work for the year ends in Montana. On account of the unusual amount of experience which these men have had, they are able to shear with great rapidity. An average of from 90 to 120 sheep is considered a good day's work for a shearer. Very large records have been made by expert shearers. Some of these records are not sufficiently authenticated, but at least 250 sheep have been sheared within a single day by one man.

Within the past five years the establishment of plants for machine shearing has progressed with great rapidity throughout the Western States. At first considerable opposition was raised to machine shearing, both by the sheep owners and by the shearers. The shearers feared that sheep could be sheared much more rapidly by this method, and therefore their business would be interfered with by the establishment of shearing plants. Sheep owners feared that the machine shearing would have a bad effect upon the sheep. It is possible to shear sheep more closely by machine than by hand, and the owners were therefore anxious concerning the effect of snowstorms or the burning sun upon the exposed skin of the sheep. The experience thus far had with machine shearing is satisfactory and favorable to the use of machines. A larger number are being established every year, some owned by companies and others owned by individuals. The motor power, as a rule, is furnished by gasoline engines, and shearing plants are constructed of various sizes, according to requirements, carrying from 10 to 35 or even 40 clippers. The number of sheep which can be sheared by machine is about the same as that by hand shearing. The ordinary shearer averages about 100 sheep per day. The advantages of machine shearing are a neater clip, less cutting of the skin than by hand shearing, and a slightly heavier fleece.

Many sheep raisers who have had extensive experience with both

methods claim that they secure about 1 pound of wool per sheep more by machine shearing than by hand work. With inexperienced shearers the cutting of the skin and injury to the sheep may be considerable by either method of shearing. It is necessary that shearers who have worked only by the hand method should be given some instruction in the use of the machines. For this purpose an expert is usually sent out with each plant and remains to give instruction to the shearers, and to see that the plant is in working order. The process of shearing occupies considerable time under the most favorable conditions, and it is therefore desirable to proceed with as great rapidity as possible. As a rule, each shearer, whether working by hand or with a machine, stands in front of a pen, which holds about ten sheep. The pen is made of sections of fence and is surrounded merely on three sides, the sheep being prevented from running out in front by the presence of the herder. The sheep are sheared, whether by hand or by machine, on a level floor, the shearer standing at the same level with the sheep. The animals are never tied or restrained in any way except by the left hand and the legs of the operator. As soon as a sheep is sheared, the fleece is kicked out of the way by the shearer, the animal is released into the pen and another one is grasped. When all the animals in the pen are sheared they are let out and the pen is immediately refilled by other sheep, which are manipulated by men employed for that purpose. The length of time required for shearing a single sheep is about four or five minutes. As soon as the fleece is removed it is tied up by a man whose only task is to tie up and remove the fleeces. A small truck running on a tramway in front of the whole line of shearers serves to carry away the tied fleeces to the end of the shearing shed, where the wool is trampled into large sacks. For the purpose of sacking the wool a scaffold is built with a circular opening at the top so constructed as to receive the hoop of the woolsack. The sack is firmly attached to the hoop and the sacker springs into the sack. The wool is then thrown into the sack and firmly trampled down until the sack is filled as full as possible. It then contains from 300 to 400 pounds, and is tied up ready for hauling away to market.

On account of the great distances from the railroad, the hauling sometimes requires so much time and so many horses that a special trade in wool freighting has been developed by men who possess wagons and horses suitable for this purpose. In freighting wool long distances by horses, economy demands that very large loads should be hauled. It is therefore not an infrequent sight to see wool-freighting teams of ten to twenty-four horses moving across the plains to the nearest wool market.

No sorting of the wool is done on the ranch, with the exception of the sacking of the wool of black sheep separately. Black wool brings a much larger price than ordinary wool, but when mixed with other

wool has to be sold for the ordinary price. On large ranches, where there are from 20 to 100 black sheep, enough black wool may be secured to fill one or more sacks, and may thus be sold for its higher market price.

The desirability of exercising care in cleaning hand shears or the clippers attached to the machinery of shearing plants has been shown on many occasions. It frequently happens that malignant edema develops to a more or less serious extent as the result of the careless cutting of the skin during shearing. Where large numbers of cases develop in a single shearing shed the place may thus become permanently infected. It is then necessary either to abandon the plant and establish another one in a new location, or thoroughly to disinfect the soil in the corral and pens and to disinfect the woodwork with which the sheep may come in contact. Malignant edema sometimes develops to an alarming extent within a few days after shearing, and in most cases the disease can be traced to infected soil where the sheep have lain down after being sheared or to the uncleanliness of shears. It would be a comparatively easy matter to dip all shears frequently in an antiseptic solution, such as formalin. The danger of spreading malignant edema by the careless cutting of the skin would thus be largely eliminated. When these precautions are taken, little harm seems to result from the ordinary cuts which sheep receive in shearing. Where, however, the cuts are of considerable extent, it is desirable to treat the skin with an antiseptic solution or to take a few stitches in the cut.

DIVISION OF THE RANGE ACCORDING TO SEASONS.

As a rule, sheep ranches are so located that the range which each man controls may be readily divided into a summer and winter range. Naturally the summer range is located at higher altitudes than the winter range or in locations where a comparatively large amount of rainfall occurs. In general, summer ranges are located on the mountains, where large tracts of high plateaus and the mountain meadows of various sizes furnish succulent forage during the months when the winter range would be too dry. The necessity of summer range for the management of sheep is in all cases very great and in many localities is absolute. The ewes require green forage during the months of June, July, and August, in order that the milk supply may be maintained at a maximum. As soon as the lambs begin to eat grass, which usually occurs at one to two months of age, they require green forage even more imperatively than the ewes. In most localities where sheep are raised on a large scale these conditions are found only in the mountains. A considerable proportion of the best grazing ground for summer use is found in forest reserves, and this explains the great anxiety of sheep men in securing the privileges for grazing during the summer in forest reserves.

The time of the year at which sheep are driven to the summer range varies greatly according to latitude and climate. In New Mexico and Arizona the sheep may be taken to the summer range in April, while in Montana, Wyoming, and other northern mountainous districts sheepmen may not attempt to enter the mountains with their bands of sheep until June or July. On the northern ranges, therefore, the sheep are not taken to summer range until after shearing, while on the southern ranges this may not be the case.

It is not the purpose of the present account to discuss in detail the bitter controversies which have arisen concerning the use of public grazing lands by sheep men, especially in the forest reserves. It will, perhaps, suffice to state briefly a few of the complications which arise from the present system of managing sheep during the summer. Sheep men maintain that the privilege of entering mountain pastures, whether in forest reserves or elsewhere, is absolutely necessary for the successful conduct of the sheep business. Cattle men, on the other hand, claim the same privilege and assert the same necessity. It is furthermore maintained by the cattle men that the presence of sheep on a given range renders impossible the grazing of cattle upon that range. It is therefore asserted that the sheep men thus have a distinct advantage over the cattle men in that the former can drive the cattle off the range by the mere presence of sheep. As already stated, no attempt can be made in the present article to pass judgment upon the merits of the two contending parties. It is apparent, however, that exceedingly unpleasant complications may arise from these conditions, and the long list of shooting affairs which occurs from year to year is sufficient evidence of the bitterness which prevails in this controversy.

Without passing judgment upon the conditions surrounding any forest reserve or other mountain grazing areas, it may be justly asserted that the sheep and cattle business can be conducted in the same locality on a peaceful basis and with profit to all parties concerned provided there is a mutual recognition of the rights of all parties. The mere presence of sheep upon a mountain meadow does not involve the destruction of the grass or timber, provided the sheep are maintained in a rational manner. That sheep grazing, however, may result in the total destruction of the range and great injury to young trees has been abundantly demonstrated in many forest reserves.

In regard to the management of sheep, whether on summer or winter range, it may be affirmed as a general proposition that the less the sheep are interfered with the less injury they will do to the range. When sheep are maintained in bands of from 2,000 to 3,000 it is necessary, for several reasons, that they should be allowed to feed in a comparatively open formation. One frequently notices the continual worrying and harassing of the sheep by young and inexperienced herders, who seem to feel that some of the sheep may be lost if the

band is not kept huddled together. The great disadvantages of keeping a large band of sheep close together should be sufficiently apparent upon a moment's thought. In the first place the injury to the grass and young trees is far greater when the bands are not allowed to spread out. The grass is trampled down, the roots injured, and the ground dug up so that erosion is much more rapid and disastrous. Then, too, the sheep have much greater difficulty in feeding. The only animals in the band which can feed with ease are those which happen to be on the outside. Those in the center of the band are crowded together by the continual pressure and are more or less effectively prevented from grazing. The result of this form of management is that the sheep have to travel much farther each day than they normally would if allowed to scatter to a reasonable distance and to feed without unnecessary interference.

The better class of sheep ranchers are men who own plants of considerable value, are definitely located, and fully recognize the great importance of preserving the summer range in as good condition as possible. They therefore give orders that the sheep should not be maintained for too long a period in any one camp, and that the camp movers or herders should move the bands of sheep to new camping grounds before any serious damage has been done to the grazing of a given locality. The range is thus preserved in a condition to produce a fair yield of grass from year to year.

Where, however, tramp sheep compete with those of local sheep men for possession of the summer range, great and even irreparable damage is done to the grass. Perhaps the chief cause of the unpleasant feelings between cattle men and sheep men, and certainly one of the chief causes of the frequent acts of violence on the summer range, is the presence of tramp sheep. Throughout the range States hundreds of thousands of sheep are owned and maintained by men who either have no permanent home or at least have no sheep ranch. These men employ herders who are instructed to move their sheep from place to place wherever they may secure grazing. Naturally the tramp sheep are maintained during the winter in the southern range country, where the climate is mild. As soon as the dry summer months appear the sheep are driven northward to Wyoming or Idaho or even farther north; the whole circuit covered by a single band of sheep during the year may be very extensive. Naturally no agreement is reached between the different tramp sheep men as to the localities which they will visit during a given season. It may therefore result that excessive numbers of sheep attempt to find grazing ground in one part of the mountains, and that the grass may be grazed off so short as to be almost destroyed for a number of years and the sheep may even then be unable to secure enough forage to prevent great loss in weight. This excessive grazing in certain localities from year to year not only causes unnecessary strife and violence between differ-

ent tramp sheep men, but also causes great inconvenience and loss to local sheep men, and particularly to cattle men. So long as the public range is considered to be anybody's property, and may be had by simply exercising a sufficient amount of violence, these conflicts will continue, together with the destruction of the range and the inconveniencing of local, responsible stock raisers.

The method of managing sheep on the summer ranges varies greatly in different parts of the country and with different sheep men. In some localities which are readily accessible, large and commodious sheep wagons follow the bands of sheep from place to place, and in these wagons the herders carry their necessary utensils, food, clothing, and beds. The usual form of sheep wagon contains a cook stove, convenient arrangement for sleeping, and a supply of food and medicines. These wagons may be hauled by two or four horses, according to the condition of the roads. In more inaccessible places one wagon may be required to furnish service for a number of herders who sleep in tents near the night camping ground for the sheep. Under such conditions each herder establishes a camp at some location protected from storms and conveniently near water, fuel, and grass. The sheep are driven each day a distance varying from 1 to 3 miles, and at night they are brought back to camp. As soon as the grazing becomes short in that locality the camp is moved some distance and the sheep are maintained about the new camp as a center for a similar length of time. The camp moving and the new location of the band of sheep are usually determined upon by the camp tender, who, as a rule, maintains his camp together with that of the herder, who is in charge of the most accessible band of sheep. In mountain districts which are inaccessible by wagon, sheep are managed in the summer by mounted herders who carry their food and bedding upon pack horses. During the day all the horses may be picketed in the neighborhood of the camp while the herder follows the sheep on foot. Herders are always assisted by sheep dogs. These dogs are a prime necessity in managing sheep under range conditions, and are particularly useful on summer range where sheep are subject to attack at night by coyotes, mountain lions, or bears. The presence of a dog under such conditions may prevent fatal stampeding of the band and consequent heavy losses.

FORAGE PLANTS FOR SHEEP.

The feeding habits of sheep differ much under different conditions. Usually the grasses on summer ranges are comparatively high, and a large proportion of the forage plants, other than grasses, is found mingled together with the grasses. Sheep eat a great variety of plants, according to circumstances, and the variations in their feeding habits are so marked as almost to preclude any general statement of their preferences under any given conditions. In fact the varia-

tions in the feeding habits of sheep of a single band may be exceedingly great. Some sheep, upon summer range, appear to prefer grasses to all other plants. The choice of grasses, however, by different sheep is by no means the same. In some of the ranges in the mountains buffalo grass prevails; in others, bunch grass and various species of blue-joint predominate. There are scarcely any native plants in the mountains which are not eaten to some extent by sheep. All plants except grasses are usually classified in one group by herders under the term "weeds." These plants furnish a considerable part of the summer forage of sheep. Chief among such plants are the native legumes (including wild licorice, false lupines, and some of the species of Astragalus, Aragallus, and Lupines), geraniums, five-finger, Spiræa, etc. Various other plants are eaten from time to time, and some of these in certain stages of growth may be more or less poisonous. As a rule, it has been found that the danger of poisoning by plants is greatest in the early part of the season, yet many thousand sheep are killed from lupine poisoning in the mountains nearly every fall. Sheep men therefore delay driving the sheep into the mountains until the time of greatest danger, as shown by experience, is past. In Montana and Wyoming it has been found to be comparatively safe to enter the mountain meadows with sheep about the 1st of July.

WATER.

The problem of securing water for sheep is always an important one. The frequency with which sheep must be watered differs according to the system of management and according to the nature of the forage plants. In parts of Arizona and New Mexico where, during the hot dry summer months sheep graze upon succulent plants, they may be maintained upon the range for a period of sixty days without water. The other extreme of frequency in watering may be observed in parts of Montana, where some sheep owners water their sheep three times per day. In general no artificial arrangements are made for convenience in securing water. Sheep are simply driven to ponds or pools (sometimes alkali pools) or to mountain streams. Some sheep men, however, have found it profitable to pipe the water from springs into troughs, where sheep may obtain it much more conveniently.

SALT.

Great differences are apparent in the practice of different sheepmen with regard to the use of salt. Some men regularly furnish salt for the sheep, so that it is accessible at all times. The salt is usually supplied in the form of rock salt, which can be licked by the animals. On the other hand, many sheepmen never supply salt to their sheep, and maintain that they have better results from allowing the sheep to find alkali licks than from supplying them salt. Many sheep men

SHEEP ON RANGE IN OPEN FORMATION.

FIG. 1.—SHEEP WAGONS.

FIG. 2.—HERDER'S CAMP.

MOUNTED HERDER.

Photograph by Dr. Pearson.

SHEEP ON WINTER RANGE.

think that perhaps the development of the so-called loco disease may be in some way connected with eating alkali or drinking alkali water, and it has been maintained by some of these men that the extent of the loco disease among their sheep diminished greatly after adopting the practice of salting their sheep regularly and thus preventing them from eating alkali. The nature of the alkali, however, must largely determine this matter. In some parts of the Western range country, where the alkali, according to chemical analyses, contains as high as 85 per cent of common salt, it must be considered as an ample substitute for artificial salt. Where, however, the alkali is composed largely of corbonate of soda, sulphate of soda, or Epsom salts, it can not be assumed that those substances can replace common salt in the physiological activities of the animal. The great differences in results which have been noted from allowing sheep to eat alkali in different localities may well be due to differences in the nature of the alkali. Except in localities where the alkali is largely common salt, it is undoubtedly better and more profitable to salt the sheep regularly.

WINTER RANGE.

The sheep are kept upon the summer range as long as the weather permits. Where sheep are maintained at tolerably high altitudes in mountain pastures it is necessary to move out of the mountains at a sufficiently early date to avoid danger of blockade in the early fall snowstorm. The limit of the safe period in this regard has been learned by experience in the various localities where the sheep industry is conducted. The time of year will naturally vary in different parts of the country, but usually sheep men prefer to drive the sheep out of the mountains before any signs of deep snows appear rather than take chances of suffering the severe losses which are occasioned by snowstorms. In the sheep-grazing portions of Montana the period at which the sheep are driven down out of the mountain ranges from September 15 to October 1. The location of a winter range is naturally chosen for its convenient proximity to the ranch house or to large sheds or haystacks. In localities where deep snows may be expected in winter the sheep must be maintained, of course, near covered corrals or a supply of hay in order to prevent disaster which might arise from becoming surrounded by snow. Throughout a large portion of the range country, however, the winter range is very favorably located with regard to the amount of snowfall. Even in the northern parts of Montana, where the temperature may reach a low point, the fall of snow upon the level plains is ordinarily very slight. Generally, sheep are able to maintain themselves in fairly good condition throughout the winter without being supplied with any hay or, at most, by a short period of feeding in case of a fall of wet snow which subsequently becomes incrusted. The high winds

which prevail upon the level plains in winter are instrumental in driving into ravines the small quantity of snow which falls and in keeping the greater portion of the range bare throughout the winter months.

In moist climates grass which is allowed to stand over upon the ground until winter is valueless. In the mountainous countries, however, with dry atmosphere, the grass appears to cure about as successfully if allowed to stand as if harvested and stacked. The result of these favorable conditions is that so long as the grass is not covered too deeply with snow sheep are able to keep themselves in good condition and do not really require any other food, unless it is desirous to maintain them in a particularly fat condition.

In order that sheep may be able to thrive well upon winter range without supplemental feeding, it is necessary that these ranges be protected during summer and that no animals be allowed to graze upon them; otherwise grass would be too short for successful grazing in winter. The sheep men, therefore, reserve a certain portion of the range at their disposal strictly for winter use and, as already indicated, seek grazing ground for summer in forest reserves or other mountain pastures. It is a fact of considerable importance with regard to the winter ranges that these tracts are covered more exclusively with grass than are the summer ranges. Weeds and other plants than grass grow much more abundantly and luxuriantly in the moister soils of the mountains than upon the plains. These plants, however, are of little value for grazing purposes in the winter, with the exception of a few especially succulent or hardy species. Among the plants other than grasses which are of value upon the winter range special mention should be made of legumes, particularly lupines and the various species of sagebrush. Sagebrush is seldom eaten by sheep during the summer, but in winter it serves to furnish a large amount of forage of considerable value. A number of species have been recognized by sheep men as of special importance and are commonly referred to as sweet sage, sour sage, white sage, etc. Lupines retain a certain portion of their leaves, and the stems also appear to be of considerable feeding value. These plants, together with the dry empty pods, are apparently relished by the sheep during the winter months.

It is not necessary to have a running water supply for sheep in winter, provided snow can be found. Sheep men may therefore in winter utilize range country upon which no running water is ever found. The sheep simply eat a quantity of snow each day, and when the snow is melted in the spring it becomes necessary to move the sheep to other range in order to secure water. The necessary water for camp purposes under such conditions is, of course, obtained by melting snow in the camp kettle.

BREEDS.

In former years a decided tendency was manifested among sheep raisers to keep only pure, or nearly pure, breeds of sheep, either fine-wool or coarse-wool, according to the product which the raiser wished to secure. Frequently, however, by taking one year with another, it has become apparent that more profit is to be obtained from raising a general-purpose sheep than by attempting to produce a wool sheep or a mutton sheep. It has therefore been found desirable to produce a cross, combining so far as possible a good mutton form and a large production of wool. In order to perpetuate the proper cross in the majority of stock sheep, it is necessary to maintain two flocks of bucks—one of Merino breed and the other of Cotswold or Lincoln. The two last-named breeds are generally preferred in Northwestern range country for crossing upon ewes with too fine wool. Naturally, as soon as the lambs show a tendency to produce too coarse wool they are in turn crossed with some race of Merino, usually Rambouillet, Delaine, etc., in order to turn the tendency of the herd in the opposite direction. It thus appears that by the judicious use of fine-wool and coarse-wool bucks a supply of stock sheep may be kept on hand which are graded so as to combine mutton and wool producing qualities in a satisfactory manner. The hardiness and fecundity of these grades is not less than those of purebred sheep under the same conditions. The admirers of various pure breeds make claims with regard to the superior ability of their particular breed to secure forage and maintain itself in good form under adverse conditions upon the range. Different sheep men, however, have had different experiences in comparing the relative values of different breeds of sheep; and the majority of sheep raisers, especially in the Northwestern range country, are at present agreed that a crossbred general-purpose sheep, such as already described, is the most successful and most profitable animal to raise.

WEANING LAMBS.

The process of weaning lambs varies with different sheep raisers and under different conditions. In cases where ewe bands are maintained in forest reserves or other mountain pastures during the summer, lambs are not separated from their ewes until the return of the sheep in the fall to the winter range. The age at which lambs are weaned varies from three to six months. The process will therefore naturally vary somewhat according to the age of the lambs. If lambs are allowed to run with the ewes from five to six months, the ewes will be nearly dry by the end of that period and will require little or no attention when the lambs are separated from them. The only precaution necessary in this connection consists in removing the lambs to some distance so that the ewes and lambs will not hear one another's calls. If the lambs are separated from the ewes within a

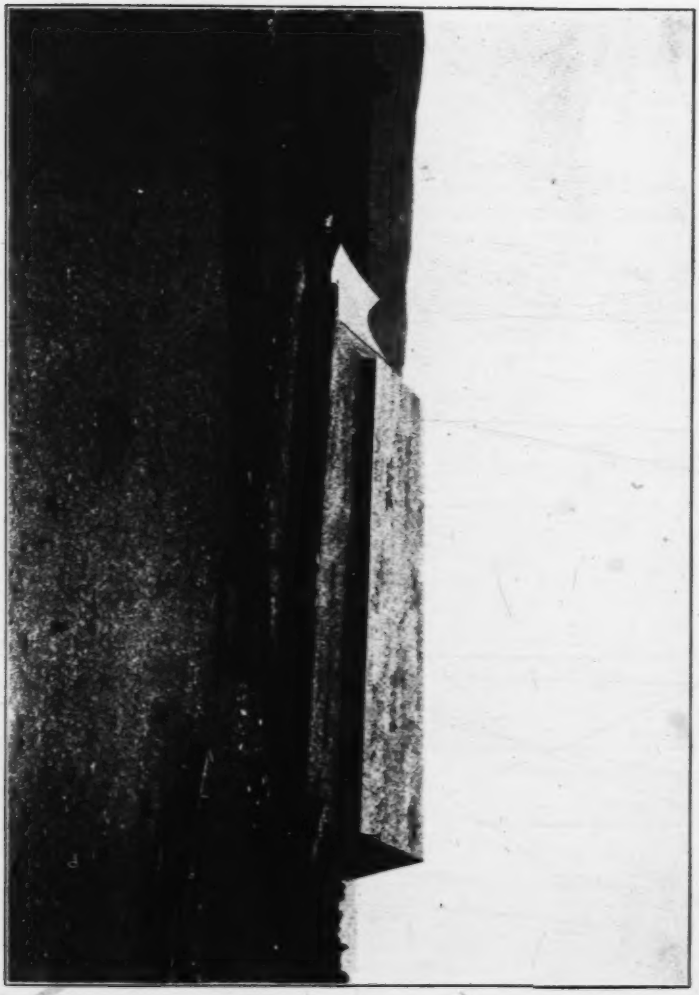
period of three months after birth, some attention will be necessary in order to prevent inflammation of the udders of the ewes for the first few days. This may be prevented by milking. Under range conditions, however, the great amount of time involved in this process renders it necessary to plan the time of weaning so that no such complications will arise after the lambs have been separated from the ewes. It frequently happens that old ewes and their lambs are prepared for market at the same time. Where this is the case they are maintained on extra fine range during the summer months and are sold together early in the fall. In such cases the lambs are not weaned.

BUCKS.

The bucks are maintained in separate bands of varying sizes, depending upon the number of sheep which a stock raiser owns—from 50 to several hundred. They are herded in these small bands upon the range by a special herder, and shortly before the bucking season and during that time usually receive additional rations of grain. In Montana and Wyoming the bucks are turned in with the ewes about December 1, and remain with them for about one month. As the period of gestation in sheep is about twenty-two weeks, or five months, this makes the lambing season fall during the month of May, which has been found to be the most desirable month for lambing in Montana and the greater part of Wyoming. In the Pacific coast States and in the Southwestern range country these periods vary according to the climate and other conditions. The number of bucks which are required for the production of vigorous lambs varies somewhat in the opinion of different sheep raisers, but, as a rule, 1 buck is furnished for each 50 ewes.

BUILDINGS.

In the early days of sheep ranging in the Western States little attention was paid to the matter of buildings or corrals. It was found absolutely necessary to construct crude corrals out of poles or brush, but frequently no attempt whatever was made to provide protection for the sheep from inclement weather. Experience has shown, however, that while it is possible to do without buildings to a large extent, increased profits are secured when proper attention is given to this subject. The result of this has been that at present the buildings and corrals of a prosperous and progressive sheep raiser are extensive and costly. In the first place, extensive lambing sheds are necessary for use during the lambing season in the spring. These, as already indicated, contain large numbers of individual lambing pens, and also larger inclosed spaces in which ewes with young lambs may be kept for a few days at a time during severe cold storms. These sheds are frequently built in very large proportions—for example, 50 to 75 feet



SHEEP SHEDS AND CORRALS.

Photograph by Dr. D. Griffiths.

DIPPING PLANT.

Photograph by Dr. D. Griffiths.

wide and 175 to 200 feet long. They are usually constructed of rough lumber, and the cracks between the boards are covered with narrow strips. Perhaps the best and most extensively used material for roofing is sheet iron, which requires painting about every other year in oder to prevent it from rusting. Recently many sheds have been constructed in which the whole exterior is covered with sheet iron. A shearing plant is almost a necessity for every large sheep ranch. This consists of extensive corrals for handling the sheep at shearing time, a covered shed of liberal dimensions for storing the wool before it is ready to market, and the actual shearing shed in which the machinery for shearing is installed, or in which booths are arranged for convenient hand shearing. Additional structures are necessarily connected with the shearing shed, such as the platform for holding the woolsack and the engine house for the protection of the gasoline engine.

The corrals which are to be seen on large sheep ranches differ according to the purposes for which they are used. A large number of cheap corrals, usually without cover, are located at various points throughout the grazing ground at the disposal of each sheep man. Each band of sheep is driven back at night to one of these corrals and remains in the corral until daylight next morning, when it is let out for feeding again. These corrals simply serve the purpose of preventing the sheep from becoming scattered during the night, and furnish some protection against the attacks of coyotes. Feeding corrals are usually more securely built, and are located near the ranch house, where the sheep are maintained during the winter season. One of the most extensively used materials for constructing these corrals is fence panels. These readily permit the construction of a corral in any desired shape, and may be held together by wires and posts set at regular intervals. An opening may therefore be made in the corral at any desired point at a moment's notice. These corrals are either built so that the sheep have long straight runways, interrupted by spaces into which teams can be driven for the purpose of hauling hay, or the sections of fence are set in a zigzag manner, so that the sheep do not have a runway of great length. They are thus prevented from racing about the corrals too much. This has been found desirable in some instances, especially with young lambs, since they may render the fattening process too slow by their excessively vigorous exercise.

Corrals for winter feeding of sheep are usually connected with open sheds in which the sheep may seek protection against snow and rainstorms. These sheds may be furnished merely with a roof, or may be walled in on all except one side. The requirements for such structures naturally vary according to the climatic conditions of the winter season. The cost of constructing sheds is in most instances more than counterbalanced by the saving of feed during the fattening period.

WINTER FEEDING.

As already indicated, little or no attention was paid to winter feeding during the early days of sheep ranching. Sheep raisers soon found that many localities could be selected where the fall of snow in winter was exceedingly light, and where, therefore, the sheep could reasonably be expected to maintain themselves safely during the winter. Whenever exceptionally heavy snows occurred, however, large losses were suffered, and these losses were especially severe in late spring snowstorms, when the sheep were already somewhat weakened by the trying climate of winter. At such times it frequently happens that a wet snow is immediately followed by freezing weather, so that a stiff crust is formed upon the snow. The sheep are thus practically prevented from securing grass, and, where no provision is made for feeding, large losses must be suffered.

As more and more persons engaged in the industry of sheep raising, and as the valuable range was more nearly taken up for this purpose, it was found desirable to produce enough hay in connection with the ranch to provide for emergencies of the kind just mentioned. The winter forage which is used in the ordinary sheep ranch is not the same in different parts of the country. Some men raise alfalfa, clover, timothy, and brome grass for feeding sheep. Alfalfa is the chief crop raised for this purpose and is by all odds the most valuable for Western range conditions. These crops, however, can not be raised, except on land where water can be obtained for irrigation. Under such conditions alfalfa can be produced very cheaply. In some parts of Montana sheep men have found that alfalfa can be produced, harvested, and stacked at 75 cents to $1.25 per ton. Practical feeding experiments carried on by sheep men on a large scale show that good alfalfa hay is worth from $5 to $7 per ton for sheep feeding. The great profit possible from raising alfalfa is thus sufficiently apparent. Some sheep ranchers raise from 100 to 1,500 acres of alfalfa yearly and feed it during the winter. This involves the maintaining of a hay gang from June until October, for three crops of alfalfa may be cut annually in Montana and a correspondingly larger number in the Southern and Pacific range States, so that as soon as the ground is cut over once it is necessary to begin again for a second crop.

Many sheep men, however, are not so favorably located or have not learned the value of cultivated forage crops. These men cut native grasses and other plants for winter feeding. In some parts of the range country wild blue-joint can be obtained to the extent of about 1 ton per acre on land upon which no work has been done. Even a larger amount of hay, made up of mixed grasses, may be obtained on marshy land, and this hay has proved in practical experience to be an exceedingly valuable feed for sheep as well as for other animals. In certain localities large quantities of plants other than grasses are cut for winter forage. Perhaps one of the most important plants in Mon-

tana and parts of Wyoming is lupine. A number of species of lupine grow to a height of from 2 to 3 feet and cover the ground continuously in large areas, sometimes whole square miles being almost exclusively occupied by some species of lupine. These plants are easily harvested, requiring about the same attention as alfalfa in curing. The lupine hay is stacked and is fed in the same manner as other hay. While the stems of these plants may be exceedingly coarse, they are eaten as cleanly as alfalfa or other cultivated hays. In some instances serious losses of sheep have been experienced from eating lupines, but these losses have not deterred sheep men from using the plant, since they have found it to be safe under ordinary circumstances. It appears that lupines are most poisonous when they contain ripe seed, and it is therefore desirable that lupine hay should be made late in the season after the ripe seeds have fallen off. This period for Montana will fall in ordinary years during the latter part of August and first part of September.

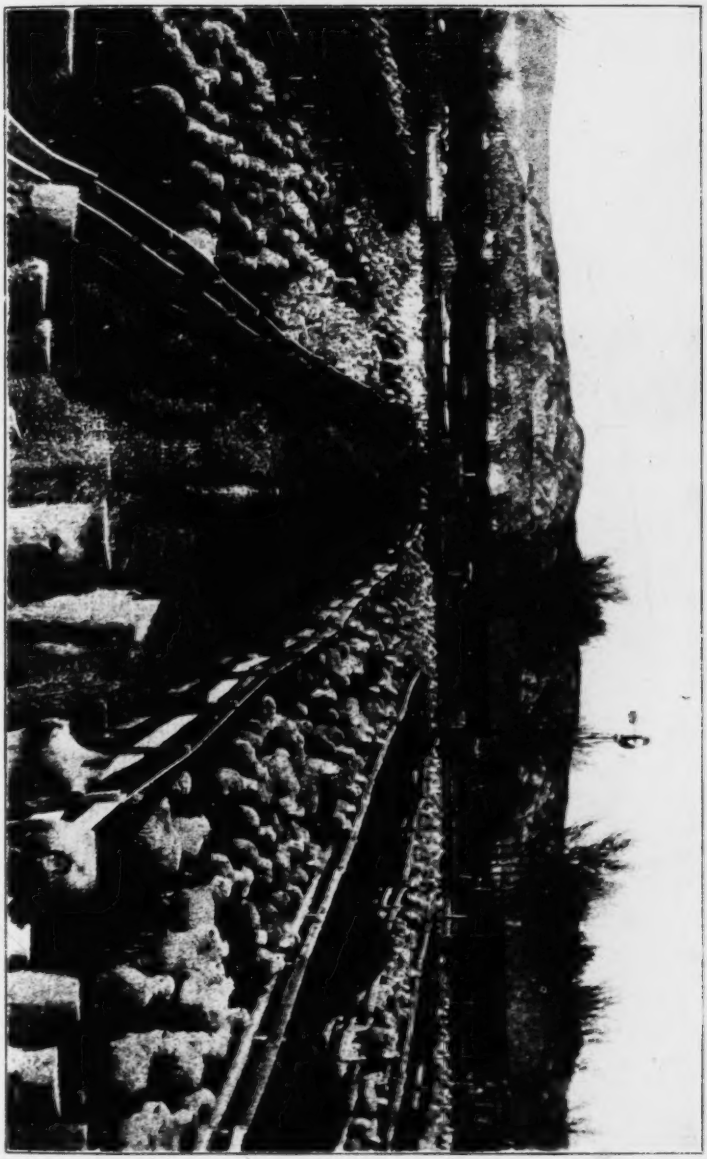
Sheep which are not intended for market, but merely for stock purposes, are naturally not forced during the winter, but are fed merely enough to keep them in fairly good condition. In order to produce this result it has been found sufficient to protect the winter range so as to leave good grass upon it for winter grazing and to feed hay at all times when the grass happens to be buried in snow. For feeding lambs in the early winter some attention must be given to market requirements, and a different method of procedure is adopted from that which is practiced with stock sheep. In feeding for the market young lambs or old sheep are placed in feeding corrals and are usually not allowed to run upon the range, but where they are given too much freedom the cost of fattening is proportionately greater. The hay which is used as a coarse feed is most conveniently fed on the ground without the use of feeding racks. In the first place, feeding racks are expensive and experience has shown that, even with the best of them, more hay is wasted than in cases where the hay is fed directly upon the ground. The most effective, convenient, and economic arrangement for feeding sheep has been found in a corral constructed of sections of board fence in a zigzag manner and so arranged that the hay can be scattered along one side of the fence while the sheep are on the other side. The fence should be boarded tight up to the height of the sheep's neck; a space should then be left of proper size for the sheep's head. It is thus apparent that the sheep can not trample upon the hay. Experience has shown that no hay is pulled through the fence by the sheep while feeding. As a rule, the space is all occupied and the sheep do not show any tendency to back out of the place and thus pull hay with them. These feeding corrals should be built so as to include a small section of a running stream, or, still better, should have a low trough of running water to which the sheep have constant access. Salt should be supplied them in

large chunks, and roots and grain may be fed in special troughs according to the desire of the feeder. In extensive experiments carried on at Bigtimber, Mont., by a practical feeder, it was found possible to put lambs in excellent market condition by three months' feeding on alfalfa hay, together with a small quantity of roots, and without any grain. Grain may be judiciously fed, however, in case it can be obtained at a reasonable price, or is grown upon the ranch. It may be stated that sheep ranchers seldom feed grain to any except the buck bands. The feeding of grain is largely reserved for sheep feeders, who buy range sheep for the special purpose of feeding them for the market.

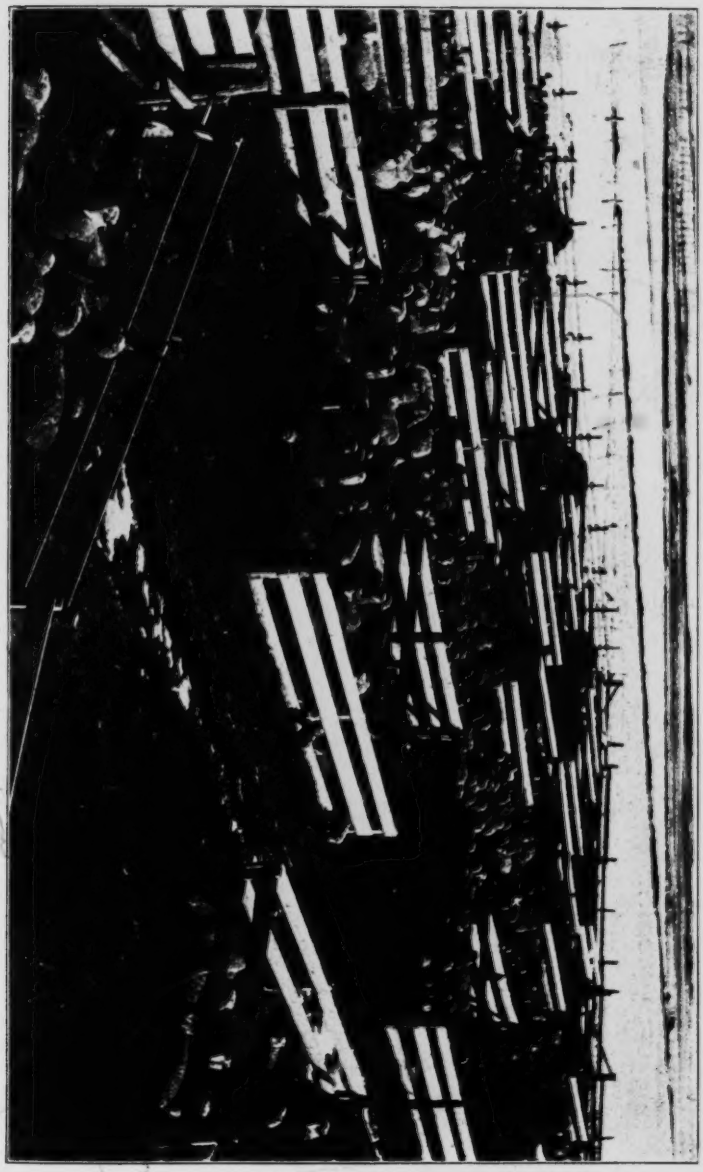
COSTS AND PROFITS OF SHEEP RANCHING.

The cost of managing sheep under range conditions necessarily varies within rather wide limits. If the sheep raiser simply makes use of public lands without paying rental and taxes, and if he is fortunate enough to find suitable grazing in localities where winter feeding is not necessary, the sheep business may be conducted at a cost of about 25 cents per head per year. On the other hand, sheep raisers who maintain extensive plants, feed in winter, and rent or own a considerable portion of the land upon which the sheep graze have found that the cost of managing sheep under these conditions varies from 75 cents to $1.25 per head per year. This estimate of the expenses includes all items of expense connected with the management of sheep under range conditions, such as horses and other animals necessary for driving and draft purposes, household expenses, etc., as well as actual management of the sheep.

The income from sheep managed under range conditions varies according to the locality and the skill and intelligence of the sheep owner. In localities where the wool is comparatively free from sand and where the fleece is of average weight, the income from the fleece of each sheep at present prices is from $1 to $1.50. The lambs may be sold in the fall at $2 to $3, depending upon their condition. By a comparatively short period of feeding considerable weight may be added to the lambs, and additional profit may be secured in this way. When the number of lambs raised to maturity is 80 per cent or above, the profits from the sheep industry, when properly managed, can be made as great as from any other legitimate business. Some of the more progressive sheep owners make a profit of as much as $1.50 per head for all sheep maintained on the ranch. Such high profits can not be obtained every year, and such an amount is certainly higher than the average. Serious misfortunes may occur, such as extensive losses from poisoning, stampeding by coyotes, etc., and these losses may greatly reduce or almost annihilate the profits for the year. The business of sheep raising under present range conditions, however, is considered exceedingly profitable, and perhaps one of the best proofs of this fact is to be found in the great increase in the number of sheep



FEEDING CORRAL, WITH STRAIGHT FENCE.



FEEDING CORRAL, WITH ZIGZAG FENCE.

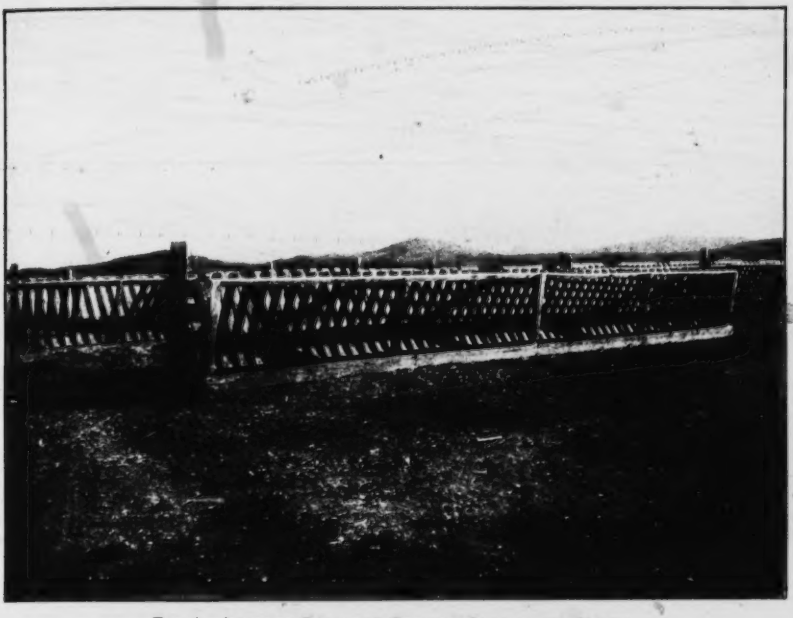


FIG. 1.—LATTICE RACK FOR FEEDING ALFALFA TO SHEEP.

FIG. 2.—BOX RACK FOR FEEDING ALFALFA TO SHEEP.

From Bulletin No. 31, Bureau of Plant Industry.

FIG. 1.—FEEDING CORRAL.

FIG. 2.—RACKS FOR FEEDING GRAIN.

and the crowded condition of the range. The undue increase in the number of sheep in a locality will, of course, be checked by the serious losses which must be experienced when such overcrowding of the range is carried too far. A natural equilibrium will therefore be maintained, at least in all localities where the larger part of the range is owned or controlled by local sheep men.

The number of sheep which can safely be maintained upon an acre is a question which has been extensively discussed and is still difficult to answer. The whole matter obviously depends upon the character of the grazing ground. In some localities an acre of ground will maintain two sheep during a whole season, while in other localities as much as 2 or 3 acres may be required for a single sheep. The amount of land required for a given number of sheep depends partly also upon the treatment which it received and upon the method of managing sheep as adopted by different flock owners. Where the sheep raiser is favorably located so that a suitable tract of land may be protected from grazing in the summer and reserved for winter use, and where care is exercised to prevent the destruction of available summer range by overgrazing, the present number of sheep may be safely increased to a slight extent. In other localities, however, the danger limit has already been passed and the range is being injured and rapidly reduced to a poor condition. This, however, is a matter which is thoroughly appreciated by the sheep men, and where the land is largely controlled by local men, so that tramp sheep can be successfully excluded, permanent injury to the range is being largely avoided. In certain parts of Montana, for example, where the land is entirely controlled by the local sheep raisers, the range has been so protected for the past fifteen or twenty years that apparently no deterioration has taken place in the quantity or quality of the forage. Under such conditions the business of sheep raising obviously rests upon a firm foundation and the owners may consequently expect reasonable profits from the business for many years to come.

As previously indicated, in localities where the land is not leased no individual or set of individuals can control the range, and the result is usually disastrous to the grass. Grazing land may be leased at one-half cent to 2 cents per acre, and in many localities may be bought at $3 to $4 per acre. Some sheep raisers maintain that the payment of even these small sums is sufficient to destroy the profits of the sheep business. This, however, seems unreasonable. A number of the more progressive sheep raisers, who lease or own nearly all the land upon which they graze, maintain that while the expense of sheep raising is somewhat increased, the range is better protected and the profits are correspondingly increased. The result is also more satisfactory on account of the stable condition in which the business is put and the confidence with which the sheep owners may look forward to a continuation of their business.

It is evidently impossible to continue indefinitely the free use of all public grazing lands. The gradual extension of sheep ranching has brought about the occupation of all public lands which are suitable for grazing. As long as no rights are acquired by any individual for the occupation of these lands, more or less serious conflict will occur, the profits of sheep raising will be reduced, and the prospects for the future will become worse and worse. It appears, therefore, that the only ultimate solution of the range question so far as sheep are concerned lies in the renting or purchasing of grazing land, so that it may be properly protected and made to yield a reasonable amount of forage; otherwise the time will soon come when a considerable reduction must be made in the number of sheep on the public range in order to prevent losses from weakness and starvation. In other words, sheep ranching, according to present range methods, has apparently reached a limit and in the future must be managed on a slightly different basis in order to insure continued profits. It does not seem reasonable to suppose that the payment of a moderate sum for rent or as a purchase price for land adds sufficiently to the expense of sheep ranching to destroy the profits of that business.

One frequently hears the statement from sheep raisers that their business is in the nature of a lottery venture—when all goes well the profits are very good, but losses of an extremely serious nature may occur when least expected. Some of these losses may be largely prevented by proper precaution. Losses from sheep scab may be controlled by dipping at proper intervals, and other simple diseases and their remedies should be well known to the sheep raisers. Losses from fall or spring snowstorms can usually be prevented by exercising special precaution during these seasons. It is well to be on the safe side and move the sheep down out of the mountains before the time for the occurrence of fall storms. As a guaranty against losses from spring storms it is desirable to provide a sufficient supply of hay to tide the sheep over periods during which they can not secure any forage upon the range. In some localities losses from poisonous plants are exceedingly severe, and suitable antidotes for these poisons have not been known until recently. The plants which cause the most extensive losses from poisoning are now fairly well known to the more progressive sheep raisers, and they can easily avoid localities in which those plants grow during the season of the year when the plants are actually poisonous. It may therefore be said that the dangers and risks connected with sheep ranching are perhaps not greater than those incurred in other business ventures, provided all possible precautions are taken to prevent the occurrence of disasters. When such precautions are taken the profits of sheep ranching under present range conditions are sufficiently great to tempt any individual with sufficient capital and industry to engage in this business.